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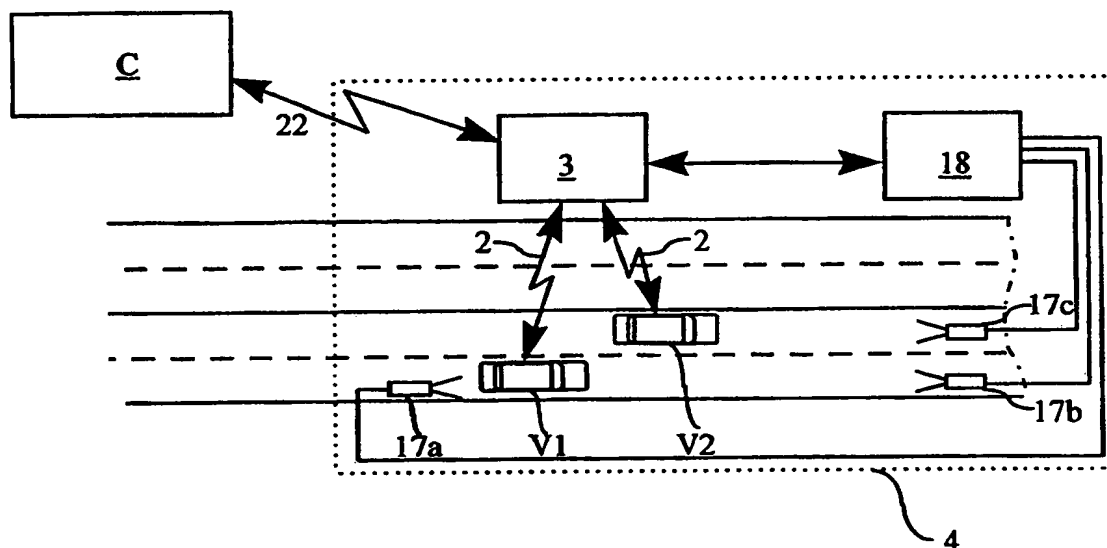
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(54) Title: METHOD FOR AUTOMATIC DEBITING



(57) Abstract

A method for the automatic debiting of charges for a vehicle (V1, V2) in a system where a vehicular debiting device (10) has contactless communication with a central system (C), where the debiting device (10) is equipped with a first identity associated with the vehicle (V1, V2) and where the debiting device (10) is, in addition, designed to store a second identity coupled to a debit account, and in the event involving levying of a charge for the vehicle (V1-V2) the first identity is sent from the debiting device (10) to the central system (C), so that the vehicle (V1, V2) can be identified, furthermore even the second identity is sent from the debiting device (10), at which a debit account can be identified, and that the central system (C) debits the charge to the debit account and if debiting the debit account fails an account linked to the first identity is debited instead.

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Method for automatic debiting

## TECHNICAL FIELD

Method for permitting the use of an identity carrier of one's choice for debiting of charges in applications where information exchange is performed by contactless communication between a vehicular debiting device and a central system for payment of charges without the necessity for the identity carrier to be specially adapted to the application.

## STATE OF THE ART

- Contactless communication is a method which is becoming increasingly important in information transfer. The dominant medium of communication is that based on microwave technology. One of the more important application areas is information exchange involving vehicles in traffic. In this case the communication occurs with the aid of a debiting device in the vehicle and a stationary roadside unit, or rather its antennas. The information exchange comprises in part an automatic debiting of charges, for instance for road tolls and parking charges. There are two principal methods of handling these charges, although a combination of both can also be employed:
- debiting an account either in advance or afterwards. Here the account associated with the vehicle, the user of the vehicle or the person who has authorized the user to use the account is identified by means of an identity (ID), unique for the debiting device, which is sent to the roadside unit, which in turn supplies the information to the central system which handles the said account. Normally, even information on the time at which the debiting operation occurred as well as the amount charged are sent from the roadside unit to the central system.
  - direct debiting via an ICC (Smart Card), which can be inserted in the vehicle's debiting device when payment transactions are anticipated.
  - the combination involves the transaction which is carried out in a Smart Card being used only to give the driver of the vehicle immediate confirmation that the charge has been debited as well as the amount charged. The "real" transaction occurs via the

central system in the account which is coupled to the card. In the event of uncertainty due to discordance between the account and the Smart Card, it is the status of the account which is valid.

- 5 Further information on electronic cash flow can be found in, for example, the patent documents US-A-4.303.904 (Chasek) and SE-9504558-9 (Hjelmare et al).

In many situations it may be necessary to be able to use a card (ICC) of one's choice as an identity carrier for debiting of charges. Examples of such are:

- 10 a) Taxi cars and certain commercial traffic: Many taxi drivers do not own the cars they drive, but either are employed to drive or hire for their own business the taxi owner's cars. Similarly, many lorry drivers do not own the vehicles they drive. In these cases it is often desirable that the charges that have accumulated, for example when using toll roads, are debited to the haulier and not the owner of the vehicles. It should be possible  
15 for the haulier to use his own card for payment of charges via the debiting device associated with the vehicle (a1). In the case of taxis an additional requirement is that the charges debited to the card are added to the fare which the taxi driver's passenger is charged and that a record of these charges appear on the passenger's receipt.
- b) when rental cars are being used it is in interest of the car rental firm that the charges that  
20 the vehicle is debited is paid by the person renting the car (b1). For persons hiring the car for business purposes it is naturally preferable that the charges debited are included in the car-rental fee so as to be able to authenticate the costs for the employer and to be reimbursed for any expenses that may have arisen (b2).
- c) For persons who use their private car for business purposes it is naturally desirable to be  
25 able to ensure that the charges are debited to the employer for those particular journeys (c1). Similarly, it is in the interests of the vehicle owner to be able to lend his vehicle

without charges for toll roads etc being debited to him instead of the driver of the vehicle (c2).

The problems described can technically be solved by using an ordinary charge card. For reasons of security as well as the need for high speeds of data transfer, this method places such demands on the card and/or the debiting device that with the present level of technology a more economically favourable alternative would be desirable. Below a method is described which offers a solution to the described problems without involving any real additional costs

## 10 GENERAL DESCRIPTION OF INVENTION

According to an aspect of the invention a method for automatic debiting of charges for a vehicle, as specified in claim 1, is presented.

The invention according to the said aspect involves, together with the point in time for the event requiring the payment of a charge and the amount charged, not only sending the identity of a debiting device associated with the vehicle to the central system, but also sending another identity in the form of the identity of an identity carrier coupled to a user of the vehicle to the central system, where the identity carrier is composed of, for example, an ICC card.

Consequently, an identity carrier of one's choice can be used. By allowing the identity of the vehicle's debiting device to constitute a guarantee that the charge can be debited, no security is required for the identity carrier, which can, for example, be a card of one's choice. If it transpires that the owner of the identity carrier, the card holder in the above example, afterwards refuses to accept the charge debited to his account, or if the account cannot be debited, then the account coupled to the debiting device is debited instead. Using this method the problems dealt with in the introduction can be resolved.

## DESCRIPTION OF FIGURES

Figure 1 shows a general view of a system for the automatic collection of tolls for vehicles where the method according to the aspect of the invention is applicable. The surveillance equipment at a toll station on a multi-lane road is illustrated in the figure.

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Figure 2 shows an example of how a debiting device associated with the vehicle, a roadside unit and a central system can be constructed, as well as communication between these units.

## DESCRIPTION OF EMBODIMENT

10 As an example of automatic debiting of charges from vehicles a system is described, with the aid of diagrams, for automatic collection of tolls for admission of a vehicle to a traffic route or traffic zone. The surveillance equipment in the system comprises a debiting device in the vehicle V1, V2 and a roadside unit 3. The debiting device consists of:

- 15 - a first communication device (1) in the vehicle V1,V2 for local communication (2) with a roadside unit (3) at a toll station (4). The first communication device (1) may consist of a transponder for the local communication (2) by means of microwaves, or analogous devices which utilize transmission media other than microwaves, such as ultrasound, light inductive transmission etc. DSRC (Dedicated Short Range Communication),  
20 where microwaves are used as the transmission medium, is preferred. Other sources that can be used as transmission media for the local communication link (2) between vehicles V1,V2 and the roadside unit (3) are UWB waves (Ultra Wide Band radio), ultrasound, infrared light, laser or ordinary light,
- a first processor (5) for calculation and/or subtraction of tolls and for guiding the  
25 communication between the vehicle's inner units and the outside world,
- a storage unit (6) for storage of data, such as the user identity associated with the



vehicle, and tariffs, etc for calculation of said tolls. The user identity may consist of a vehicle identity, a purse identity or a transponder identity,

- a reader (13) for reading and debiting of an identity carrier 14, exemplified here as a smart card.

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The physical toll station (4) comprises:

- a roadside unit (3) which has a second communication device (16) for the local communication (2) with a first communication device (1) in one of the aforesaid vehicles V1, V2,  
10
- video equipment (17a-17c) as well as suitable lighting equipment for reproduction of characteristic features of the vehicle V1, V2, such as the number plate, and for detection of the vehicle's physical shape, including necessary image processing equipment (18) with OCR functionality (Optical Character Recognition) for identification of registration  
15 number or equivalent features,
- a second processor (19) in the roadside unit (3) for determination of the position of the vehicles V1 and V2 within the physical toll station, based on information from measurements with the aid of
  - a) the local communication (2) between the first communication device (1) in the vehicle  
20 V1, V2 and the second communication device (16) in the roadside unit (3),
  - b) information from the image processing equipment (18) as well as
  - c) by correlation of the positions obtained from measurements carried out with the help of both communication devices (1, 16) and information from the image processing equipment (18),
- a storage unit (20) in the roadside unit (3) for storage of data relating to positions  
25 obtained by the local communication (2) between the first (1) and the second (16)

communication device,

- equipment (21) in the roadside unit (3) suitable for transmission (22) of recorded data to the central system (for instance, by GSM, WAN or via optical fibre networks) and
- encrypting equipment for encrypted transmission of data between toll station (4) and central system C.

5

Apart from the above mentioned units, it is assumed that the central system C includes the requisite equipment in the form of a third processor (23), a central storage unit (24), a SAM (Security Application Module) (25), communication equipment (26) for communication (22) with the toll station's 4 communication equipment (21), from where transmission (22) of data from the roadside unit (3) to the central system is effected.

10

In a debiting system such as the one exemplified, an identity carrier 14 coupled to a user of the vehicle is employed. It is recommended for simplicity sake that the identity carrier be comprised of some kind of card, such as a charge card or credit card. The use of an identity carrier for the type examples a-c mentioned in the introduction is described below, where the corresponding solutions according to the aspect of the invention are referred to by a1-c1, a2-c2 (the references a, b, c refer to the examples of debiting described in the section "State of the art" above). The identity carrier 14, in the case where it is comprised of a smart card, is inserted into the vehicle's V1, V2 debiting device 10, whereby the debiting device's reader 13 can read the identity of the identity carrier 14.

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(a1) A haulier in a haulage contracting business uses his own card for payment of charges. If debiting subsequently proves to be impossible from an account coupled to the card, the payee will instead debit the account of the owner of the haulage vehicles via the identity of the debiting device 10 associated with the vehicle. The problem of identifying which haulier is liable for payment of the charge is thus transferred to the owner of the

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vehicles, who with an oversight of who is using a particular vehicle and when it is being used should be able to resolve this.

(b1) In the same way as in (a1) the problem regarding who is liable for payment is transferred to the car rental firm. The additional feature described below permits a more refined solution.

(c1) For business trips in a privately-owned car a company card could be the card of choice. If the account coupled to this card does not sanction the transaction, the charge is deducted from the account coupled to the vehicle owner's (i.e. the employee) vehicle unit, in which case it is the responsibility of the company and the employee to have a procedure for tracing the charges. Even in this case the additional feature described below permits a more refined solution.

(c2) Identical method to (c1), but with the company card replaced by the driver's card.

By allowing a logbook to be kept of the transactions made with the chosen card, the invention provides a solution to the other problems above:

(a2) By allowing the card to function as an information carrier the logbook can be transferred to the haulage vehicle owner's logbook for subsequent inspection and charging if necessary. Similarly, information on charges debited can be transferred to the passenger's receipt of payment.

(b1) and (b2)

Being able to subsequently transfer information on collected toll charges and other charges, allows, in the case of the rental car, the car rental firm to pay for the card, since it is now possible to transfer the charges levied onto the invoice on return of the vehicle. Naturally, this also allows the possibility of rendering accounts and direct invoicing in the case of business trips.

(c1) In the case of a privately-owned car used for business purposes the logbook of the card also provides an advantage, since on return to the company one has the possibility of

accounting for the charges levied.

An alternative design of the above is for the said card to be replaced by a keypad with which credit card numbers or equivalent can be recorded in the vehicle's debiting device by the driver of the vehicle for the desired time.

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The automatic debiting system can naturally be employed in many situations other than in the collection of tolls. Examples of such include payment for services or goods at so called "drive in" or "drive through" establishments.

## CLAIMS

1. Method for the automatic debiting of charges for a vehicle in a system where a vehicular debiting device (10) has contactless communication with a central system (C), where the debiting device (10) is equipped with a first identity associated with the vehicle (V1, V2) and where the debiting device (10) is, in addition, designed to store a second identity coupled to a debit account, characterized in that in the event involving levying of a charge for the vehicle (V1 - V2) the following steps are executed:
  - the first identity is sent from the debiting device (10) to the central system (C) so that the vehicle (V1, V2) can be identified,
  - the second identity is also sent from the debiting device (10), at which a debit account can be identified,
  - the central system (C) debits the charge to the debit account,
  - if debiting the debit account fails an account linked to the first identity is debited instead.
2. Method according to claim 1, characterized in that the debiting device (10) is allowed access to the second identity by insertion of an identity carrier (14), such as an ICC card of one's choice, in the debiting device (10)
3. Method according to claim 1, characterized in that the debiting device (10) is allowed access to the second identity by entering the second identity using a keypad on the debiting device (10).
4. Method according to claim 2, characterized in that the identity carrier (14) is equipped with a storage device in which transactions carried out by the central system (C) are entered so that these transactions can subsequently be read for carrying out payment transactions between the owner of the first identity and the owner of the second identity.

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Fig. 1

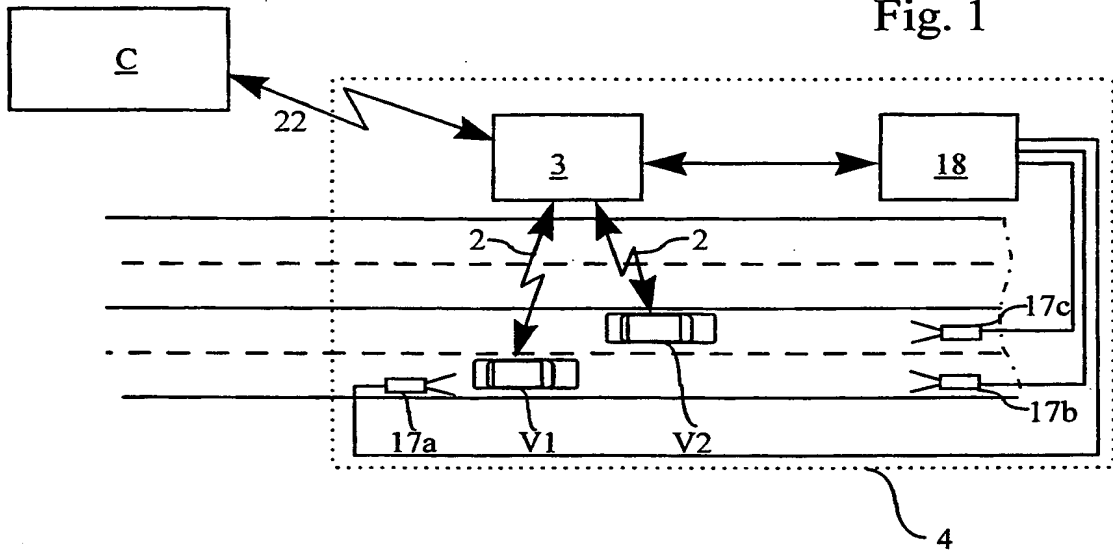
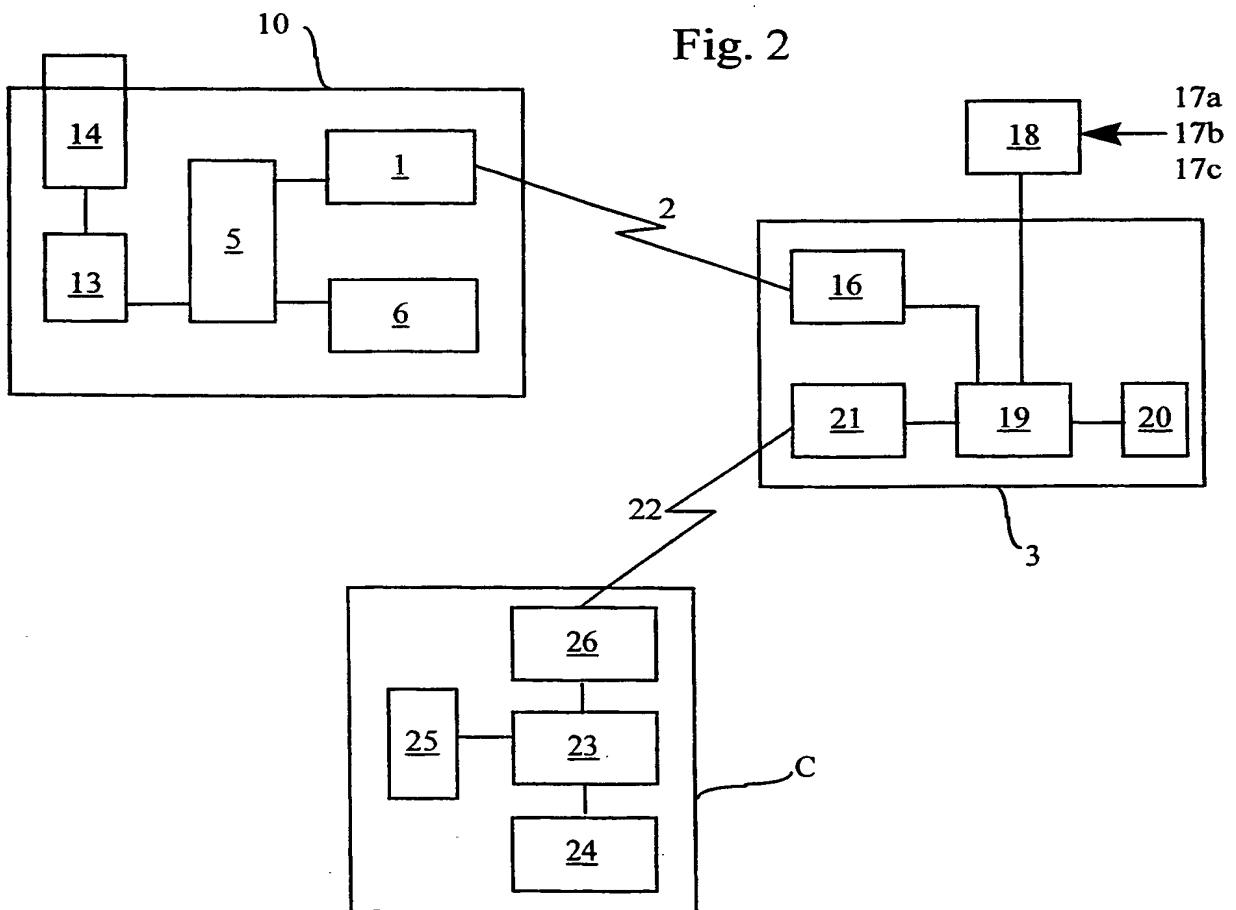


Fig. 2



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/00242

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: G07B 15/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: G07B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0784297 A2 (NEC CORPORATION), 16 July 1997 (16.07.97), column 2, line 1 - column 3, line 35  --	1-4
A	GB 2294795 A (WILLIAM MUNRO GROVES PATERSON ET AL.), 8 May 1996 (08.05.96), abstract  -- -----	1-4

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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International application No.  
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0784297 A2	16/07/97	CA 2194826 A JP 9190554 A	12/07/97 22/07/97
GB 2294795 A	08/05/96	GB 9522182 D GB 9421939 D	00/00/00 00/00/00